Maritime Planning Support System (MPSS) for Fleet Battle Experiment Juliet (FBE-J)

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Abstract

The Naval Research Laboratory (NRL) and Ball Aerospace & Technologies Corp.(BATC), under funding from ONR-31 and in cooperation with the Naval Warfare Development Command (NWDC), is developing a Prototype Maritime Planning Support System (MPSS). MPSS is part of a multi-year effort by NRL and BATC to develop collaborative planning technology for net-centric warfare. The system is designed for initial use in Fleet Battle Experiment Juliet (FBE-J) to take place during July and August 2002. The main MPSS initiative for FBE-J is to help develop and evaluate a Joint Forces Maritime Component Command (JFMCC) operational C^2 process that will prioritize multiple tasks with limited naval assets and conduct the full range of Effects Based Operations (EBO) in a joint environment. MPSS is a distributed, web-based infrastructure designed to stimulate, coordinate, manage, and monitor the underlying processes (workflow) represented by the JFMCC's planning process including the Joint Maritime Operations Plan, Maritime Support Request (MARSUPREQ), Master Maritime Attack Plan (MMAP), and Maritime Tasking Order (MTO).

1. Introduction

1.a Objectives

MPSS is designed to provide a proof of concept that illustrates how a distributed, collaborative knowledge management system can facilitate the JFMCC planning process. Specifically, the

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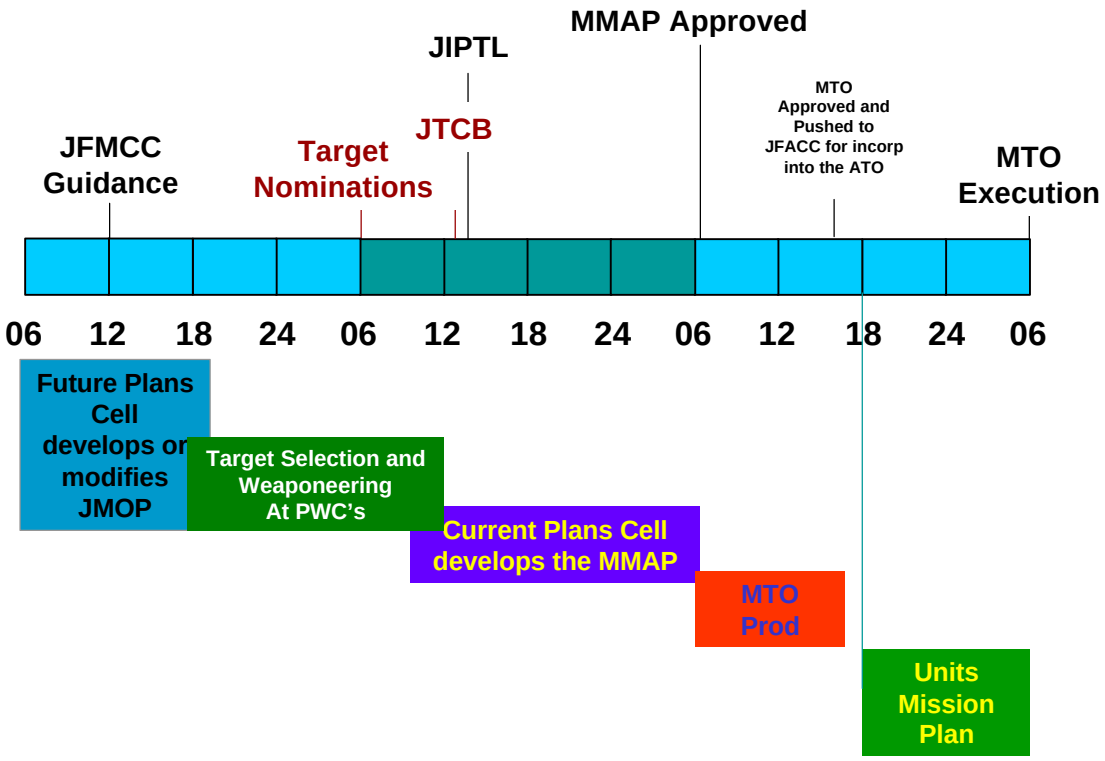

Figure 1 - The 72 hour JFMCC Planning Cycle

MPSS will assist planners with the prioritization, integration and synchronization of the maritime missions within an acceptable time frame. To this end, the MPSS will:

1. Provide semi-automated workflows that regulate the flow of information through the JFMCC planning cycle. This will include automated notification of applicable persons when actions are required or completed, logging of critical events, generation of critical process milestones, and maintenance of process state for user monitoring.
2. Provide a web-based workflow monitor that:
    a. Presents current state of each MTO planning cycle.
    b. Provides statistical insight into the status and effectiveness of the planning activities.
    c. Permits individual tailoring that presents only the information a user wants to see.
3. Provide a shared workspace into which artifacts of the planning process can be stored and made available to the entire planning community.

Figure 1 illustrates the planning cycle used in the JFMCC planning process. Each cycle takes about 72 hours and culminates with the execution of a Maritime Tasking Order. There are nominally 3 overlapping cycles ongoing on any given day.

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1.b Approach

The MPSS will apply an off-the-shelf commercially available framework to facilitate the JFMCC planning process in three principle ways:

- As an object model of the objects and personnel involved in the process. Instances of the object model's classes will represent the state of each concurrent planning cycle
- As a work process model using a Workflow authoring tool and an intelligent Workflow agent to monitor and manage the state data contained in the object model
- As a visual presentation of the process status, accessible through a standard web browser such as Internet Explorer

The MPSS will be a fully integrated package that leverages off other planning tools currently under development to support the JFMCC. Using the Java 2 Enterprise Edition (J2EE) programming platform, the MPSS will apply emerging technology including Enterprise Java Beans, Intelligent Agents, dynamic web based view generation, document management and user profiling to facilitate the employment of the legacy tools. EJB's provide the standard interfaces into the models of the process while Intelligent Agents serve as smart adapters for tools and databases. Web browser access eliminates the need for software installation on client workstations. Server-side view generators using Java Server Pages have the capability to query the models and the Intelligent Agents to obtain current process state information.

MPSS represents an advance in technology application to an emerging planning process. It will enable up-to-the-minute visibility of planning status to all participants in the process, regulate the flow of information among participants by automating notifications and monitoring progress as the plan evolves, and provide a user-configurable view portal so that each user will configure a presentation that fits the user's roles and responsibilities on the planning team.

2. Overview of JFMCC Command and Control Requirements for FBE-J

FBE-J will be conducted in conjunction with U.S. Joint Forces Command's Millennium Challenge 02 (MC02) joint field experiment from 24 July to 15 August 2002 in the U.S. Western training and test ranges. MC02 is a congressionally mandated, SECDEF-directed experiment being conducted with all the services and Special Operations Command. It will assess the ability of the Joint Force to conduct a rapid decisive operation (RDO) within the decade. FBE-J will experiment at the operational and tactical level of war focused on command and control and assured access to enable RDO.

The main initiative is to develop and evaluate JFMCC operational command and control process that will provide a capability to prioritize multiple tasks with limited naval assets and conduct full range of Effects Based Operations (EBO) in a joint environment. The process will accommodate simultaneous offensive and defensive operations at the tactical and operational levels and will allow the JFMCC to synchronize all naval missions in the littorals.

The experiment will focus on the Command and Control (C2) processes centered at the operational component level. The sensors and engagement architecture will allow forces to respond quickly to fleeting targets and allow them to commit weapons and move sensors with knowledge of the impact those decisions will have. A Principal goal is to apply the concepts of Network Centric Warfare (NCW) to the JFMCC structure. This will include deliberate planning, Intelligence, Surveillance, and Reconnaissance (ISR) asset management and allocation of resources, weapon apportionment and sensor-weapon-target pairing. FBE-J will concentrate allocation, reallocation and target assignment, and fire mission deconfliction for both preplanned and TST engagements at the component level (JFMCC).

To synchronize and schedule naval air, surface, and subsurface platforms, these units must operate within a planning and execution process to use the limited platforms across surface warfare (ASUW), strike (STW), mine countermeasures (MCM), air defense (AD), undersea warfare (USW), and amphibious warfare (AMW) while applying "instride tactics," not sequential tasks. The JFMCC does not have a defined process of selecting precision targets, applying appropriate assets to those targets, wargaming for optimal positioning and scheduling, promulgating this plan in a CJTF parsable format. Nor does it have the abilility to then execute the plan while conducting time sensitive target acquistion, engagement and assessment utilizing dynamic weapon target.

This initiative allows the commander to synchronize all aspects of Naval Fires and other naval missions in the littorals: search, maneuver, and protect as well as strike. It optimizes assets in scheme of maneuver as well as targeting. This process does NOT replace the need for functional naval warfare commanders. The specific tactical plans will still be drafted and executed by the warfare commanders. This process will allow the Maritime Commander to control the tempo and focus of the overall maritime campaign plan.

Currently there are no available naval toolsets to help in this process. There are many systems that are available to assist the separate warfare areas to optimize their particular focus, but none that ties all of the Maritime missions together. One of the objectives of this initiative is to continue to define the requirements that will lead the development for a naval planning toolset.

During FBEH on board the USS MOUNT WHITNEY, C2F and Naval Warfare Development Command (NWDC) established a JFMCC which performed the tasks described above to examine process requirements. The JFMCC planning staff was an attempt to experiment with one possible naval command and control (C2) organization that focused and synchronized limited multi-mission Navy platforms across the full spectrum of JFMCC littoral operations. The JFMCC aligned the battle rhythm and supporting documentation to the CJTF targeting cycle then used a maritime tasking order to task then conduct maritime operations.

During FBE-J the concept will be further tested and will focus and synchronize limited naval assets across the full spectrum of maritime littoral operations and take advantage of previous FBE experiment results in EBO and increased planning tempo.

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For this experiment the command and control structure will employ principal warfare commanders (PWCs) subordinate to the JFMCC. They are: Air Defense Commander (ADC), Information Warfare Commander (IWC), Sea Combat Commander (SCC), Strike Warfare Commander (STWC), Mine Warfare Commander (MIWC) and Amphibious Warfare Commander (AMWC). The warfare commanders are responsible for collecting and disseminating information and, in certain situations, are delegated authority to respond to threats with assigned assets. Principal warfare commanders, when so authorized, may autonomously initiate action. In many aspects of maritime warfare, it is necessary to preplan the actions of a force to an assessed threat and to delegate some command functions to a subordinate. Once such functions are delegated, the subordinate is to take the required action without delay, always keeping the JFMCC informed of the situation. The JFMCC and/or delegating commander retains the power to negate any particular action.

Figure 2 presents an overview of this Command and Control structure.

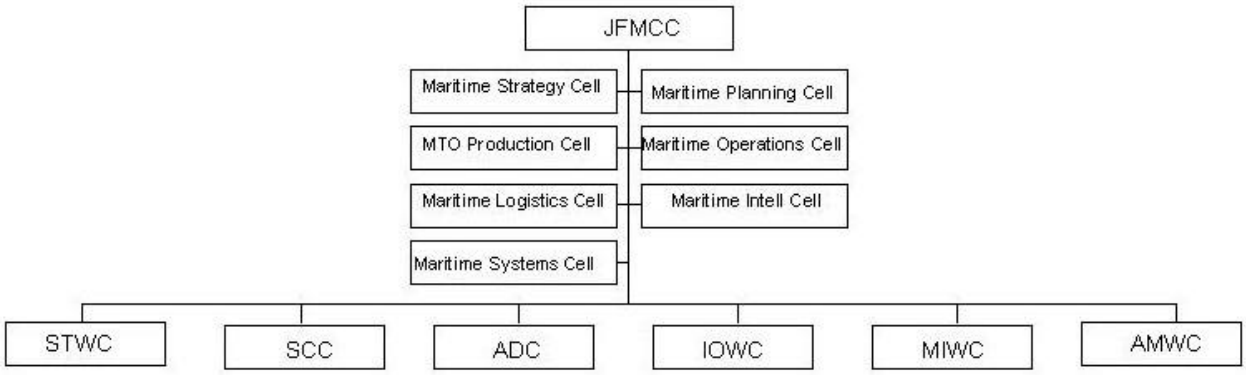

Figure 2 - JFMCC Command and Control Structure

3. Using MPSS for JFMCC Maritime Tasking Order Production

The success of network centric operations relies on the ability to share information quickly across all levels of the warfare network. All this information must be in a data format that is compatible with the network. Currently the daily tasking of Navy units is done differently for air and surface units. Air platforms used for "common use by the CJTF" are tasked by the ATO promulgated by the JFACC. Air platforms used for "direct support by the JFMCC/NAVFOR" are tasked by a separate ATO or Airplan promulgated by the JFMCC/NAVFOR. Navy surface platforms are tasked individually by each PWC (SCC, STWC, etc) via Daily Intentions Messages (DIMs).

A Maritime Tasking Order (MTO), a single database-formatted document, will replace the Airplan/DIM as the tasking vehicle for the JFMCC/NAVFOR and Navy PWCs. This will share information up, down, and across the chain of command. A USMTF database, compatible with ATO, will provide:

- "Online" Drafting/Execution

- Information that includes all Maritime Missions (Not Just Air)
- A database that is parsable by time, platform, target, etc

The staff will use a collaborative targeting and planning process to prioritize, integrate, and synchronize maritime missions within an acceptable planning cycle. This will provide maritime commanders with an effective targeting and planning process.

The relationships between the Joint Force Air Component Commander (JFACC) and the JFMCC, and between the Maritime Tasking Order (MTO) and Air Tasking Order (ATO) will be incorporated. Preplanned as well as dynamic battlespace integration should be analyzed. This will elevate the Airspace Control Authority/Airspace Control Order to a Battlespace focus, deconflicting space, air, land, and water - the future of maritime planning.

MPSS will integrate with the JFMCC planning processes being developed by NWDC Maritime Battle Center (MBC) for use during FBE-J to provide the solution to Joint Force collaborative planning. During FBE-J, the MPSS/JFMCC solution will provide automated system support for the Warfare Commanders, Maritime Planning Cell, MTO Production cell, and the Maritime OPS

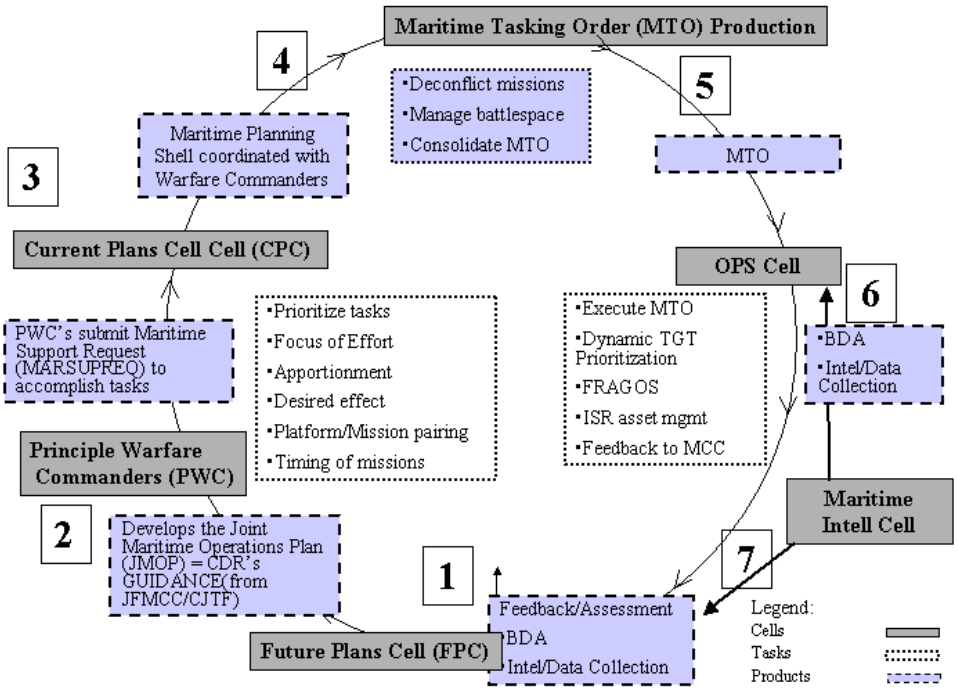

Figure 3- The JFMCC Planning Cycle

cell as they perform their respective tasks. Steps in the JFMCC planning cycle, numbered according to Figure 3, are outlined below:

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STEP 1 – Future Plans Cell. Drafts the Joint Maritime Operations Plan (JMOP) delineating the maritime operations to support the CJTF campaign plan. JMOP is distributed to Warfare Commanders. Every day the JFMCC refocuses priorities based on the dynamics of the battlespace and the tempo of the campaign. The MPSS will initiate this process by allowing the collaborative generation of the JMOP to launch the workflow.

STEP 2 – Principle Warfare Commanders. Take the direct and implied tasks directed by the JFMCC in the JMOP, as modified by daily guidance, and submit a listing of assets required to accomplish the tasks required to support the commander's priorities. This is called the Maritime Support Request (MARSUPREQ). The MPSS will tie together information from external systems and intelligently provide the listing of assets to accomplish the tasking.

STEP 3 – Current Plans Cell. Combines the tasks from the JMOP, mission plans from the warfare commanders submitted in the MARSUPREQs, and current tactical environment to develop prioritized tasks, scheme of maneuver, apportionment, and desired effect for the next 48 hours. The MPSS will provide a "Smart form" initialized by agent or with attached intelligent scripting to query, display and score assets for user selection to facilitate task prioritization.

STEP 4 – Maritime Planning Shell (MPS). This document will be distributed online to the appropriate planning groups located within the warfare commanders' staffs. The warfare commanders will collaborate with the Maritime Planning Cell to modify the shell to incorporate the platform: preplanned mission pairing; the expected sequence in which missions are to take place, time-on-target estimates, collection requirements to measure desired effect, and any other specific detail only available at the warfare commander level. Using collaborative MPSS planning tools online should reduce the time for this step.

STEP 5 – MTO Production Cell. After the warfare commanders have approved the maritime planning shell, this group will allocate assets, deconflict the missions, consolidate this information into a single MTO, and promulgate it through the MPSS document management system making it available to users worldwide.

STEP 6 – Maritime Operations Cell. From the Maritime Operations Center, executes day-to-day the MTO and dynamic battle control of emerging targets and requirements. Publishes modification orders within the MPSS to modify the MTO.

STEP 7 – Maritime Intelligence Cell. Observes and assesses maritime battlespace results and immediately provides appropriate feedback. The MPSS will provide the necessary information for the commander to make an assessment through the presentation of battlespace awareness information via Web portals.

NWDC has developed a suite of web-based data entry forms using the Macromedia Cold Fusion application development system. This system permits web-based entry and maintenance of the principle elements of the JMOP, creation of MARSUPREQs and development of MTOs. Data entered through the forms are stored in either MS ACCESS or SQL 7 databases. ACCESS is

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used in development and testing while SQL 2000 is used operationally. The product of the development process is a set of Cold Fusion scripts that execute in a Cold Fusion Server that runs in conjunction with the web server to convert scripts into html for delivery to the client web browsers.

DoD has established a standard set of collaboration tools designated as the Defense Collaboration Tool Suite (DCTS). The only tools permitted for use in a collaborative (human-to-human interaction) environment are those that use Microsoft NetMeeting or Sun Sunforum as the basic building blocks. The suite includes CUSEEME Networks Meeting Point Servers; Microsoft NetMeeting, Digital Dashboard and Outlook; and Sun Microsystems SunForum. No other tools are permitted for use by the DoD. Since Information Workspace (IWS) incorporates NetMeeting and SunForum, it fully meets the requirements and is authorized for use. Consequently, for FBE-J, IWS was chosen as the tool for human-to-human collaboration. The MPSS architecture is based upon a COTS framework, called Knowledge Kinetics, developed by BATC and AFRL [1].

The following sections describe the initial features, services, and models of the MPSS.

Portal Page

The portal page will be the primary user interface to view planning process status information. The MPSS "enterprise home page" or portal will be built as a "web part" for inclusion in the JFMCC Share Point Portal for FBE-J. The User View Manager on the architecture diagram (Figure 4) is the collection of Java Server Pages that generate the various portlets for the enterprise. The JSP will obtain status data from the Planning Process Status model maintained within the infrastructure's Enterprise Model. The JSPs will also interact with the Viewable Assets model in the Enterprise Model as well as the Viewable Assets Master List and the User View Profile. There will be (at least) the following three portlets:

JFMCC Planning Process View

The JFMCC Planning Process View will be a dynamically updated portlet that shows the status of the MTO planning cycle. This cycle begins with creation or modification of the JMOP. It ends with Battle Damage Assessment. This cycle nominally occurs on a 72-hour basis. Figure 5 depicts the JFMCC Planning Process View. Each icon on the diagram represents a major stop in the planning process. Color overlays will indicate cycle status. A user may select the Process Status Detail View for any step in the process by clicking on one of the icons on the Planning Process View.

State information for each of the steps in the process will be obtained from the appropriate objects in the Enterprise Model. Each step will be have one of three states: inactive, active, or complete. The color overlays will change from gray to blue to green respectively

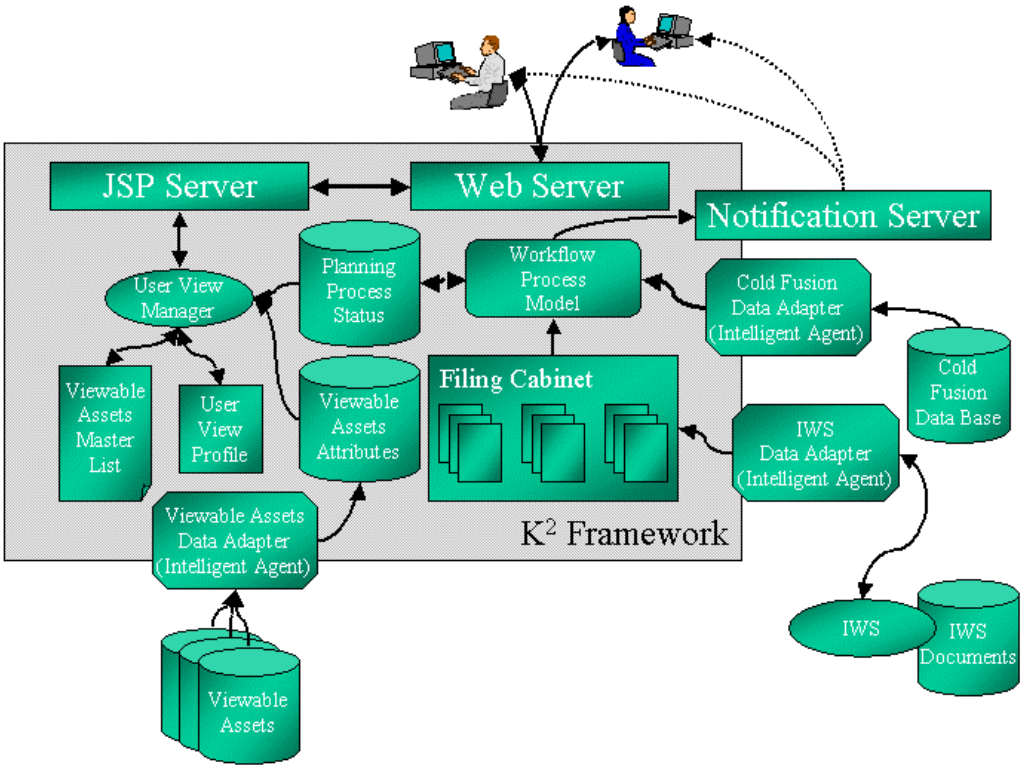

Figure 4 – The MPSS Architecture

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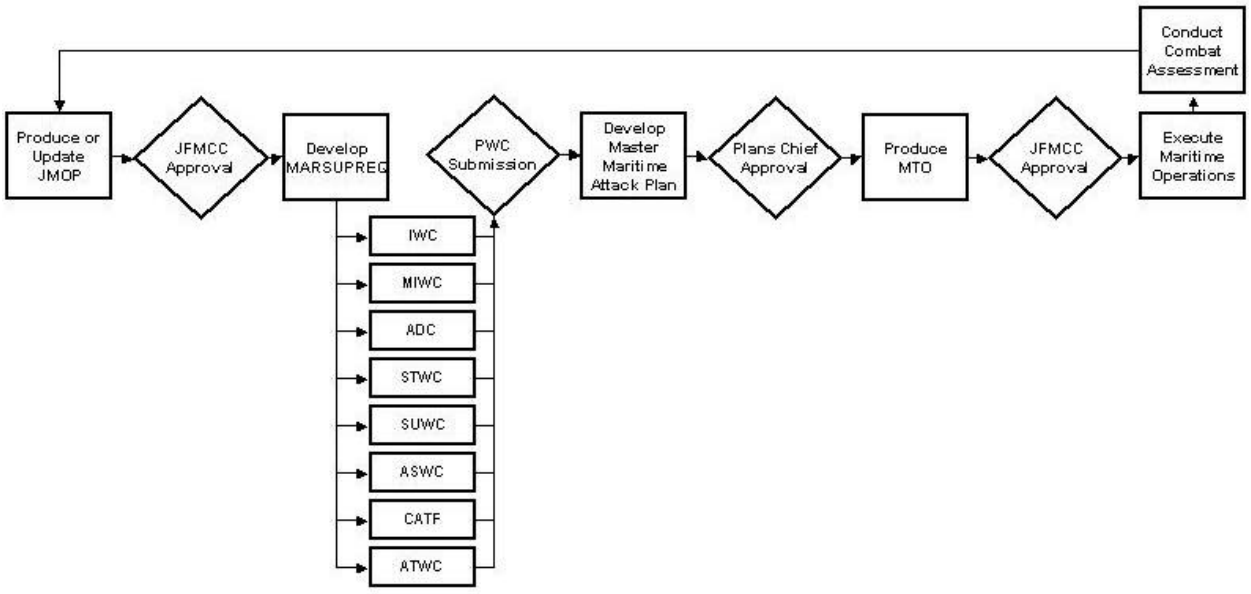

Figure 5 – The Planning Process View

Process Status Detail View

Process Status Detail views will provide information about each of the steps in the process depicted above in the Planning Process View. The Process Status Detail View will be generated by an applet that polls the Enterprise Model for state information and updates the diagram shown above by changing the color of the step icon to reflect its state. Users will obtain detail views by clicking on the icons in the Planning Process View. JSPs that generate the detail views will obtain status detail from the Planning Process Status Model in the Enterprise Model.

Information Discovery View

The Information Discovery View is the user tailorable display of viewable assets available on the JFMCC network. There are two types of user interaction required to provide these views. The first user interaction will be by the System Administrator. This facility will provide the administrator the capability to construct a list from which users will select the assets they want displayed in their Information Discovery View. While constructing this list the administrator will also identify the source of the information. The second type of user interaction will be user selection of assets the user wants to display in their specific view portlet.

Viewable Assets Master List

This list will be constructed by the System Administrator and will be the list from which users will define their specific views. The Viewable Assets Model, and object model in the K^2 Enterprise Model, will contain the objects that will support this list. One of more JSPs will support construction of the list by the administrator and selection from the list by individual users.

User View Profile:

Also in the Enterprise Model, this will contain individual user selections from the Master Assets List. There will be a user profile for each user.

Workflows

K^2 Workflows will provide the mechanisms for maintaining the state data displayed in the various views described above, issuing notifications to appropriate users when required, and logging specific planning events for later review. The Maritime Planning Process – View Mirror Workflow, shown in Figure 6, mirrors the JFMCC Planning Process View as a backup facility or an alternate way of viewing the planning status.

4. Summary

During FBE-J MPSS is expected to provide an important component to the JFMCC in the production of an MTO. Also, due to its open architecture non-application centric approach, MPSS is a natural partner to other fleet initiatives that are working towards information and knowledge advantage solutions for the warfighter. The underlying framework of MPSS could be effective wherever you have a process that pulls together disparate people, systems, and information to achieve a common goal.

References:

[1] Sheldon Gardner and Lawrence Filippelli, "A Virtual Collaboration Testbed for C2", Command and Control Research and Technology Symposium, Monterey CA, June 2000.

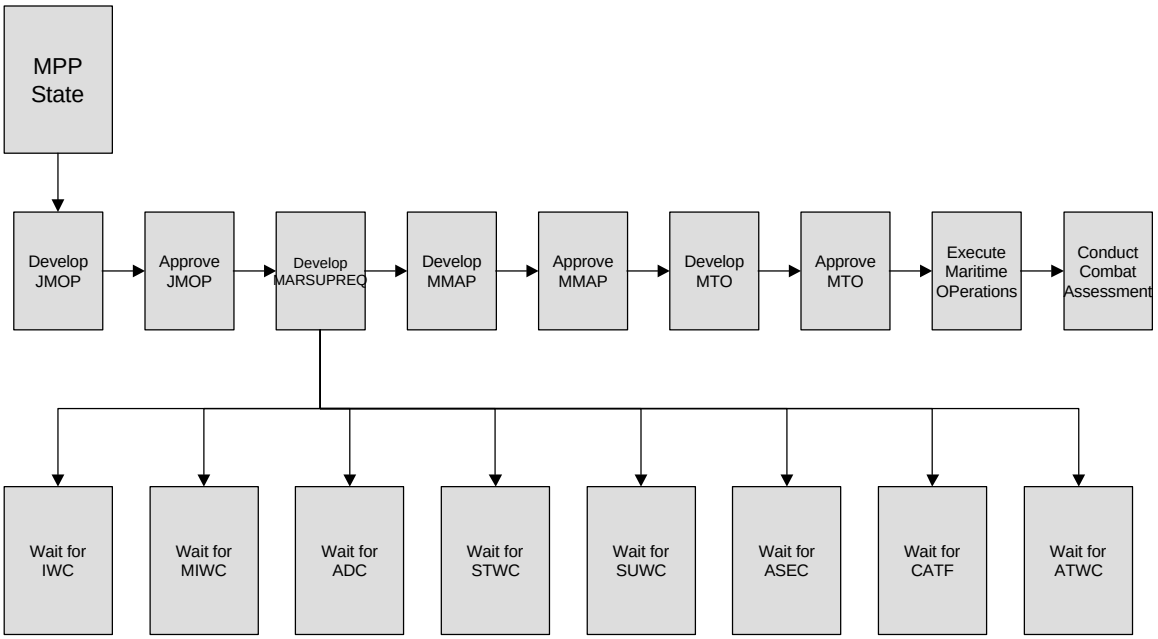

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Figure 6- View Mirror Workflow

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